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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/629,407	08/01/2000	Allan Rosencwaig	TWI-10820	6057

7590 06/27/2002

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EXAMINER	
SONG, HOON K	

ART UNIT	PAPER NUMBER
2882	

DATE MAILED: 06/27/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

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09/629,407	08/01/2000	Allan Rosenowaig	TWI-10820	6057

7590 02/22/2002

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EXAMINER
SONG, HOON K

ART UNIT	PAPER NUMBER
2882	

DATE MAILED: 02/22/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/629,407	Applicant(s) ROSENCWAIG ET AL.	
	Examiner Hoon K Song	Art Unit 2882	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-31 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-31 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 01 August 2000 is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 6,10 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Drawings

Figure 1-2, and 5 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

New formal drawings are required in this application because hand wrote drawings are not preferred. Applicant is advised to employ the services of a competent patent draftsperson outside the Office, as the Patent and Trademark Office no longer prepares new drawings. The corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

The drawings are objected to because box, 60 in figure 1 is empty. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application

being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claims 1-2, 8-12, 18-21, and 27-31 are rejected under 35 U.S.C. 102(e) as being anticipated by Komiya et al. (US 6040198).

Regarding claims 1, 11, 20 and 29, Komiya teaches a method and apparatus comprising:

Generating a probe beam of X-rays (column 5 line 33);

Directing the probe beam onto the surface of the patterned wafer such that the spot size of the probe beam is large relative to the feature size of the pattern on the surface of the patterned wafer (column 5 line 34+);

Measuring the intensity of various X-rays as reflected from the patterned wafer to generate reflectivity data (column 5 line 37+); and

Analyzing the reflectivity data to determine characteristics of the thin film layers (abstract).

Regarding claims 2, 12 and 21, Komiya teaches that the characteristics include thin film layer thickness (column 6 line 4+).

Regarding claims 8, 18, 27 and 30, Komiya teaches that the analyzing the reflectivity data step includes applying a Fourier transform (column 3 line 18+).

Regarding claim 9, 19, 28, Komiya teaches that the analyzing the reflectivity data step includes applying a transform function to the reflectivity data and further wherein the transform function is chosen based on a comparison of the reflectivity data with x-

ray reflectivity data corresponding to measurements made on an unpatterned region of a semiconductor wafer (figure 2, column 6 line 48+).

Regarding claims 10 and 31, Komiya teaches that the reflectivity data includes data measuring reflected x-ray intensity as a function of angle of incidence (figure 5a).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 3-7, 13-17 and 22-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Komiya et al in view of Koppel (US 569548).

Regarding claim 3-6, 13-16 and 22-25, Komiya does not specifically teach about detectors.

However, Koppel teaches different kinds of detectors (column 4 line 48+).

In view of Koppel, it would have been obvious to an artisan of ordinary skill in the art at the time the invention was made to adopt those different kinds of detectors in order to resolve the x-rays reflecting from the test sample along the one axis (column 4 line 50). Accordingly, one would be motivated to adopt those detectors because they are well known and preferably used in the radiation detecting art (column 4 line 55+).

Regarding claims 7, 17 and 26, Komiya does not specifically teach a directing step.

However, Koppel teaches the directing step including focusing and reflecting the x-rays using a curved monochromator (37, figure 2).

In view of Koppel, it would have been obvious to an artisan of ordinary skill in the art at the time the invention was made to adopt the focusing and reflecting step in order to direct the x-ray (column 3 line 17+). Accordingly one would be motivated to adopt the directing step because it would improve the x-ray flux directed toward the sample surface (column 3 line 58+).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hoon K Song whose telephone number is 703-308-2736. The examiner can normally be reached on 8:30 AM - 5 PM, Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Kim can be reached on 703-305-3492. The fax phone numbers for the organization where this application or proceeding is assigned are 703-746-4858 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

ROBERT H. KIM
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800

Hoon K. Song
February 19, 2002

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INFORMATION DISCLOSURE CITATION (Use several sheets if necessary)	Docket Number (Optional) TWI-10820	Application Number 09/629,407
	Applicant(s) Allan Rosencwaig et al.	
	Filing Date August 1, 2000	Group Art Unit 2876

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U.S. PATENT DOCUMENTS

EXAMINER INITIAL	REF	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
	BA						
	BB						

FOREIGN PATENT DOCUMENTS

	REF	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
HKS	BC	2720131	11/21/1997	Japan (w/translation)	G01N	23/207	X	
	BD							

OTHER DOCUMENTS

(Including Author, Title, Date, Pertinent Pages, Etc.)

HKS	BE	K. Sakurai et al., "Fourier Analysis of Interference Structure in X-Ray Specular Reflection from Thin Films," *Jpn. J. Appl. Phys.*, Vol. 31, 1992, pp. L113-L115.
	BF	K.N. Stoev et al., "Review on grazing incidence X-ray spectrometry and reflectometry," *Spectrochimica Acta Part B*, Vol. 54, 1999, pp. 41-82.
	BG	N. Wainfan et al., "Density Measurements of Some Thin Copper Films," *Journal of Applied Physics*, Vol. 30, No. 10, October 1959, pp. 1604-1609.
	BH	J.P. Sauro et al., "Some Observations on the Interference Fringes Formed by X Rays Scattered from Thin Films," *Physical Review*, Vol. 143, No. 1, March 1966, pp. 439-443.
	BI	K. Sakurai et al., Analysis of thin films by X-ray scttering at grazing incidence," *SPring-8 User Experiment Report No. 2, (1998 A)*, March 1999, p. 162.
	BJ	L.G. Parratt, "Surface Studies of Solids by Total Reflection of X-Rays," *Physical Review*, Vol. 95, No. 2, July 15, 1954, pp. 359-369.
	BK	M.F. Toney, "Measurements of carbon thin films using x-ray reflectivity," *J. Appl. Phys.*, Vol. 66, No. 4, 15 August 1989, pp. 1861-1863.
	BL	J.T. Fanton et al., "Multiparameter measurements of thin films using beam-profile reflectometry," *J. Appl. Phys.*, Vol. 73, No. 11, 1 June 1993, pp. 7035-7040.
	BM	J.M. Leng et al., "Simultaneous measurement of six layers in a silicon on insulator film stack using spectrophotometry and beam profile reflectometry," *J. Appl. Phys.*, Vol. 81, No. 8, 15 April 1997, pp. 3570-3578.
	BN	O.H. Seeck et al., "Analysis of x-ray reflectivity data from low-contrast polymer bilayer systems using a Fourier method," *Applied Physics Letters*, Vol. 76, No. 19, 8 May 2000, pp. 2713-2715.
HKS	BO	E. Chason et al., "Energy Dispersive X-Ray Reflectivity Characterization of Semiconductor Heterostructures and Interfaces," *American Institute of Physics*, 1996, pp. 512-516.

Examiner HKS	Date Considered 2-19-02

Examiner: Initial if citation considered, whether or not citation is in conformance with MPEP Section 609; Draw line through citation if not in conformance and not considered. Include Copy of this form with next communication to applicant.

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FORM PTO-1449 (Modified) (Rev. 7-80)	U.S Dept. of Commerce Patent and Trademark Office	Atty Docket No. TWI-10820	Appln. No. 09/629,407
INFORMATION DISCLOSURE CITATION (Use several sheets if necessary)		Applicant(s) Allan Rosencwaig et al.	
		Filing Date August 1, 2000	Group 2876

U.S. PATENT DOCUMENTS

*Examiner Initials		Document Number	Date	Name	Class	Subclass	Filing Date
HKS	AA	5,371,582	12/06/1994	Toba et al.	356	73	07/30/1993
	AB	5,619,548	04/08/1997	Koppel	378	70	08/11/1995
HKS	AC	5,740,226	04/14/1998	Komiya et al.	378	70	11/27/1996
	AD						

FOREIGN PATENT DOCUMENTS

*Examiner Initials		Document Number	Date	Country	Class	Subclass	Translation YES	Translation NO
HKS	AE	0 352 740	07/25/1989	EPC	H01L	21/306		
HKS	AF	EP 0 768 512	10/15/1996	EPC	G01B	11/06		
	AG							

OTHER DOCUMENTS

	AH	
	AI	

Examiner	Date Considered
HKS	2-18-02

* Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Notice of References Cited

Application/Control	Applicant(s)/Patent Under Reexamination	
09/629,407	ROSENCWAIG ET AL.	
Examiner	Art Unit	Page 1 of 1
Hoon K Song	2882	

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-6040198	03-2000	Komiya et al.	438/16
	B	US-5619548	04-1997	Koppel	378/70
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

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	N					
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	P					
	Q					
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	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.